A STUDY OF FUNCTIONAL OUTCOME OF SURGICAL MANAGEMENT OF IPSILATERAL FEMUR AND TIBIA FRACTURES (FLOATING KNEE INJURIES)

Dissertation submitted for

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APRIL-2013

DECLARATION

I, DR.SIVASARAVANAN hereby declare that this dissertation **"A STUDY OF FUNCTIONAL OUT COME OF SURGICAL MANAGEMENT OF IPSILATERAL FEMUR AND TIBIA FRACTURES (FLOATING KNEE INJURIES)"** is a bonafide, genuine research work done by me under the guidance of PROF.Dr.A.PANDIASELVAN, PROFESSOR OF THE DEPARTMENT OF ORTHOPAEDIC SURGERY, MADRAS MEDICAL COLLEGE, Chennai.

Place
Date

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CERTIFICATE

This is to certify that this dissertation **entitled "A STUDY OF FUNCTIONAL OUTCOME OF SURGICAL MANAGEMENT OF IPSILATERAL FEMUR AND TIBIA FRACTURES (FLOATING KNEE INJURIES)** is a bonafide research work carried out by DR.S.SIVASARAVANAN in the Department of Orthopaedic Surgery. MADRAS MEDICAL COLLEGE FROM may2011- Dec 2012 under my guidance for partial fulfillment of the requirement for certification of master of surgery-II in Orthopaedic Surgery.

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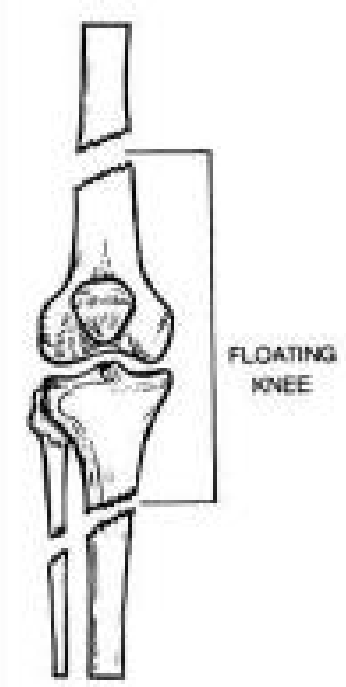
CONTENTS

INTRODUCTION

Ipsilateral fractures of femur and tibia in adults are also known as floating knee Injuries. These are injuries with serious complications. High velocity trauma is a cause. Associated with extensive skeletal and soft tissue Injuries, injuries of head, chest and abdomen.

Infection, excessive blood loss, maluninon, non union , knee stiffness and prolonged immobilization are the leading causes of complications. We in south india as one of the leading orthopaedic and trauma centres present our Experiences in treating floating knee injuries.



AIMS

To analyse the functional outcome of a group of patients sustaining ipsilateral femur and tibia fractures using KARLSTROM AND OLERUD'S CRITERIA.

OBJECTIVES

1) To study the new cases, patterns and morphology of ipsilateral femur and tibia fractures, their management modalities and result.

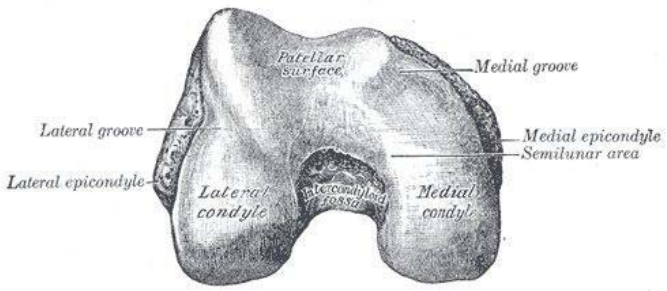
2) To identify any modifiable factor affecting the eventual functional outcome

ANATOMY OF THE KNEE

The knee joint is a pivotal hinge type of joint. The movements flexion, extension and moderate degree of medial and lateral rotation takes place in knee joint. It is weight bearing joint.

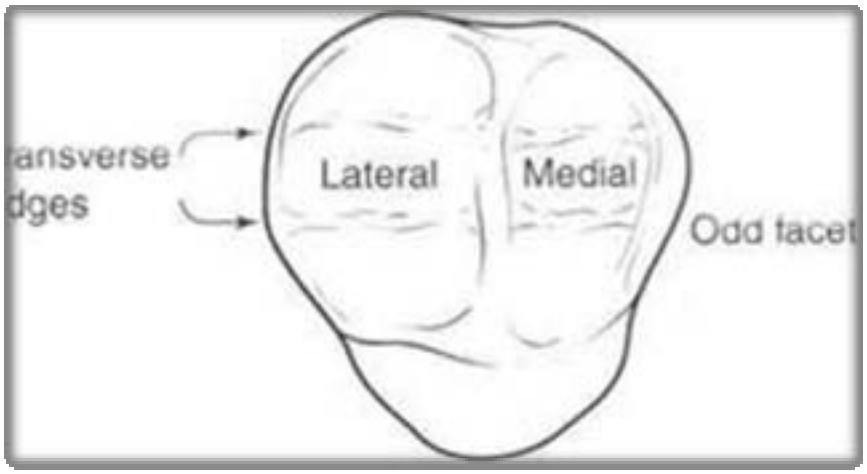
ARTICULAR BODIES

The femur has lateral and medial condyles which are its articular bodies. The lateral condyle is wider than the medial condyle has a more constant width. The condylar curvature in the sagittal plane becomes small posteriorly. This diminishing radius produces a series of involute midpoints (i.e. located on a spiral). The transverse axes permits both sliding and rolling movements in the knee ensuring the collateral ligaments are sufficiently lax to permit the rotation associated with the curvature of the medial condyle about a vertical axis. The pair of tibial condyles are separated by the intercondylar eminence composed of a lateral and a medial tubercle.



The patella is a sesamoid bone in quadriceps.

It has seven facets. Medial and Lateral facets are divided into 3rd s. The 7th facet is most medial (odd facet) Medial half is usually smaller Thick hyaline cartilage



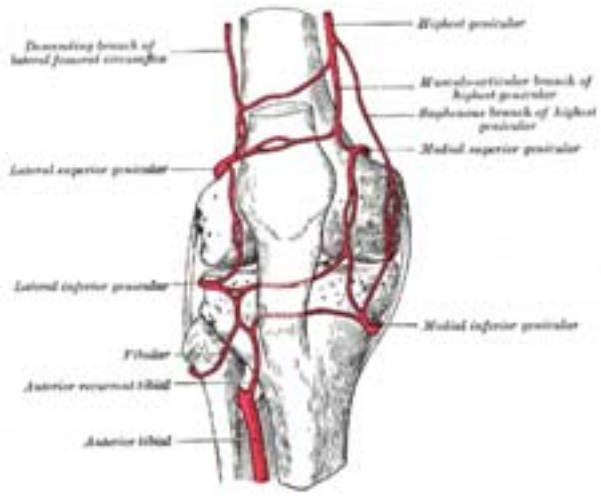
The patella is inserted into the thin anterior wall of the joint capsule On the posterior surface of patella is a lateral and medial articular surface both of which communicate with the patellar surface. These unite the two femoral condyles on the anterior side of the bone's distal end

BLOOD SUPPLY

The vascular supply to the knee is a complex anastamosis of two separate systems the intrinsic and extrinsic SYSTEMS.

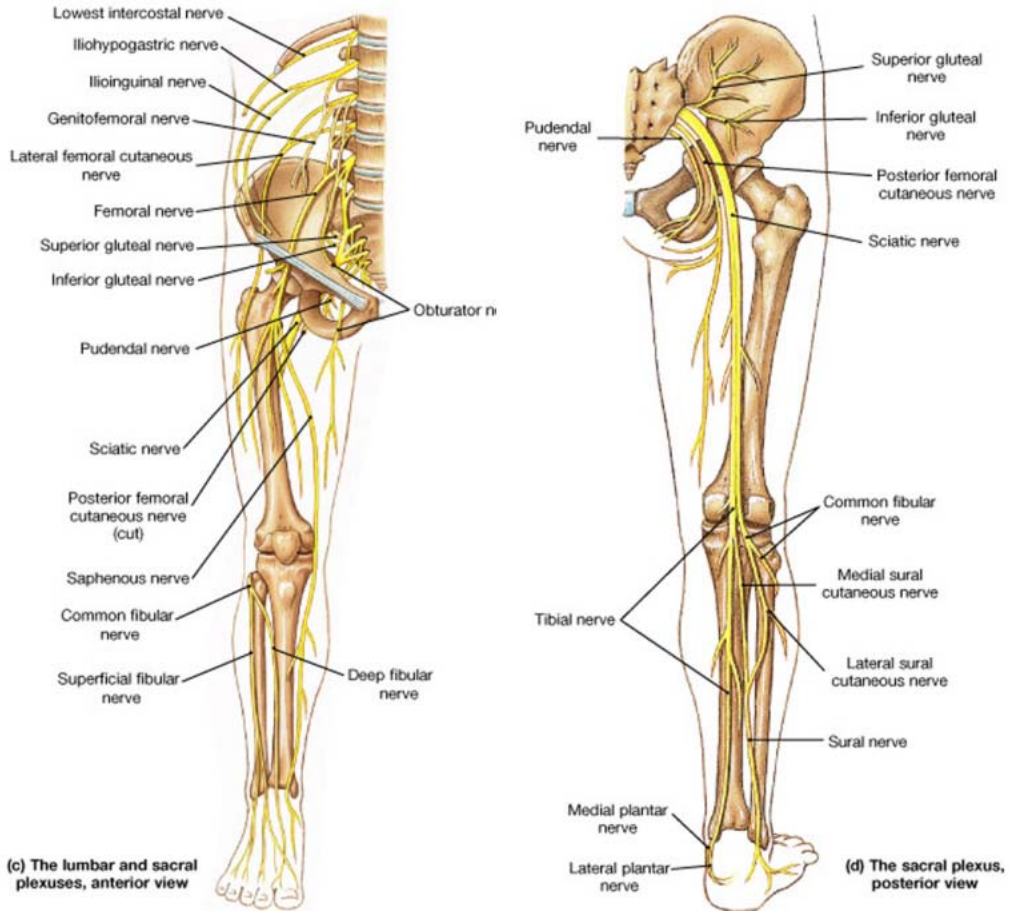
The intrinsic supply is an anastamotic ring made up of the articular,Muscular and five geniculate arteries (superomedial , superolateral, middle, inferomedial and inferolateral).

The extrinsic system is made up of a branch of descending superficial femoral artery , branch of anterior tibial artery and branch of the lateral femoral circumflex artery.



NERVE SUPPLY

Nerve supply to the knee is from the branches of femoral nerve and of the sciatic nerve.



LIGAMENTS AROUND THE KNEE

LAYER-1

Most superficial Anterior-arciform layer Medial-sartorius Lateral-iliotibial band and biceps femoris

LAYER-2

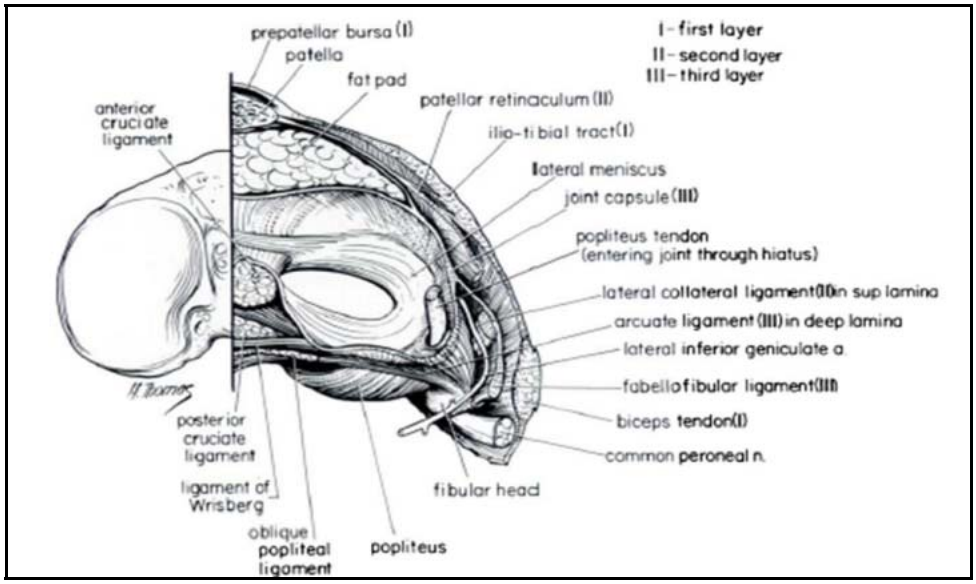
Patellar tendon, Medial and lateral collateral ligament

LAYER-3

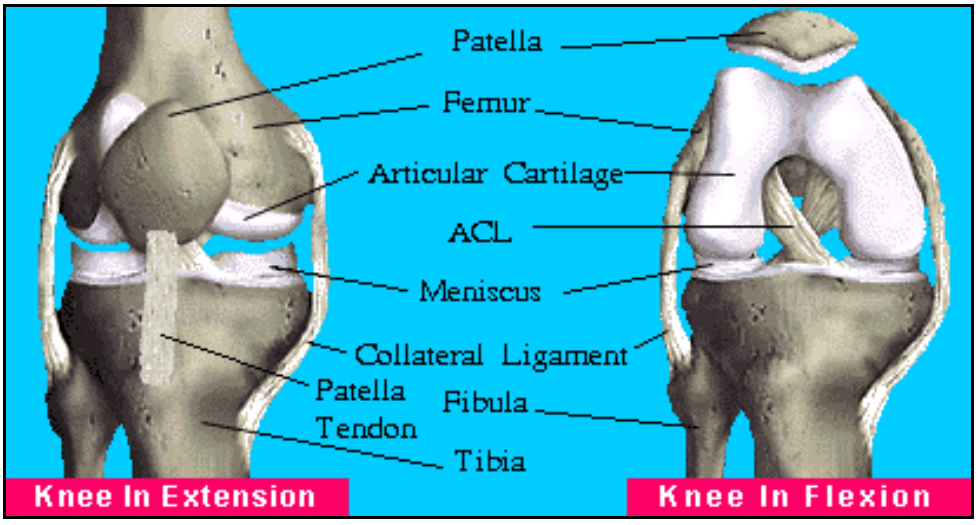
Joint capsule

Arcuate

Deep medial collateral



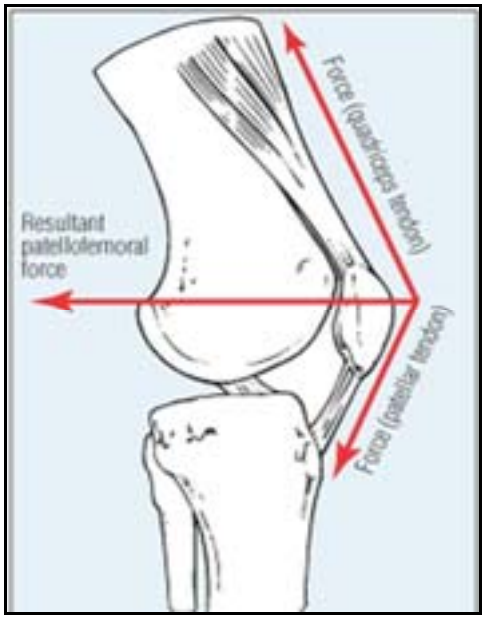
KNEE IN EXTENSION AND KNEE IN FLEXION



PATELOFEMORAL BIOMECHANICS

The joint Reactive Force in flexion, patella compressed onto femur creating joint reactive force

Stair climbing – 3.5 X BW Deep bends – 7-8 X B



REVIEW OF LITERATURE

For floating knee injuries in the 1970s and 80s, conservative management was preferred and surgical intervention with implant fixation was criticized. Complications such as non union, delayed union, osteomyelitis, knee stiffness and deformities were seen.

The management techniques of these injuries gradually evolved due to,

1) Better understanding of functional anatomy and biomechanics of the knee joint

2) Awareness of the associated injuries.

3) The advent of internal fixation devices.

4) Microsurgery for neurovascular injury.

5) Aggressive soft tissue management.

In 1975, Blake and McBryde reported a series of forty seven patients.

Most of them had injuries with high velocity trauma and complications of these fractures were frequent. Delayed union

or non union occurred in 44.6% of the total number of bones involved. 60% to 70% of the adult patients showed significant. Permanent functional disability.

In 1977 Karlstrom and Olerud reported thirty two patients with floating knee injuries, fourteen patients were treated by rigid internal fixation or external fixation for both fractures. Three patients had internal or external fixation of one fracture and conservative treatment of the other.

Fifteen patients underwent non operative management for both fractures. The patients who were treated operatively for both fractures had a lower incidence of complications, shorter duration of hospitalization and shorter time to healing. An active surgical approach produced considerably better functional end results. Twelve of fourteen patients treated surgically, resumed their former occupations compared with four of thirteen patients treated non-operatively.

In 1978 Fraser reported two hundred and twenty two patients with ipsilateral fractures of the femur and tibia6. Patients were grouped according to the type of fracture and the method of treatment; sixty three patients were clinically examined.

The worst results were in those following non operative management of both fractures. Following this, more use of external fixation and of cast bracing was in the recommended management of the fractured tibia. Internal fixation was advised for the femoral fractures. Clinical examination of the knee at post operative or follow up suggested that disruption of ligaments (collateral or cruciate ligaments) was a common occurrence and should always be suspected in the presence of recurrent knee instabilities.

In 1972, Winston reported twenty four patients who had non operative management. Despite many complications the author felt that this treatment was safe.

In 1979, De Lee reported treatment of floating knee injuries in seventeen patients with cast bracing for both fractures as definitive management. Shortening and malunion was common with this type of management.

Later in 1986 Letts et al analyzed fifteen patients with floating knee injuries and classified it into five types according to the location and nature of fractures Letts classification is preferred since it classifies the nature of injury either closed or open as well

as the anatomical location of fractures. These factors have been shown to influence both the treatment and outcome.

In 1987 Behr described flexible intramedullary nailing for patients with shaft fractures and achieved good results.

In 1996, Gregory described retrograde nailing of the femur and unreamed nailing for the tibia.

Lobenhoffer in 1997 described a complex knee joint trauma which includes floating knee injuries with severe soft tissue injury, knee dislocation, vascular and neurological injury. This was treated with reduction and fixation techniques to reduce the complications.

In 2000, Ostrum described percutaneous single incision retrograde nailing of femur and ante grade nailing of tibia. This gives good results.

Rethnam in 2006 reported that irrespective of ligament injury due to the procedure itself, the single incision nailing for the floating knee injuries produce good results.

Lf in Rethnam, Rajam S. Yesupalan and Rajagopalan Nair, did a study on floating knee and its epidemiology, prognostic

indications and outcome following surgical management. This study included 29 patients with floating knee injury. The follow up period was over 3 years. The study concluded that the associated injuries and the type of fracture are the prognostic indicators in the outcome. Good final outcome can be obtained by the management of associated injuries, intramedullary nailing of both femur and tibia and good post operative rehabilitation.

Lundy DW, Johnson KD, The authors had given a brief outline on ipsilateral fractures of femur and tibia, the definition of floating knee injuries.

The definition is as follows 'Ipsilateral fractures of femur and tibia and may include combination of diaphyseal, metaphyseal and intraarticular fractures.'

Diaphyseal fractures are better than intraarticular fractures for the outcome.

Anoop Kumar did a study on ipsilateral femur and tibia fractures in forty two patients. The treatment comprised of external fixators and internal fixators depending upon the type of fractures.

They concluded that poor outcome was seen with compound injuries and articular fractures. Excellent results were seen in patients treated with rigid intemal fixation.

G Anastopoulos conducted a study on ipsilateral femur and tibia fractures. The study included thirty two patients (twenty male and twelve female). All the cases were due to road traffic accidents. They had eighty one percent excellent or good and nineteen percent acceptable or poor results.

CLASSIFICATIONS

The classification used for this study is Blake and Mcbryde's classification for floating knee injuries.

The other classifications available are

- Lett's classification
- A.O distal femur classification
- Schatzker tibial plateau classification

BLAKE AND MCBRYDE'S CLASSIFICATION

Type-1: True Floating Knee

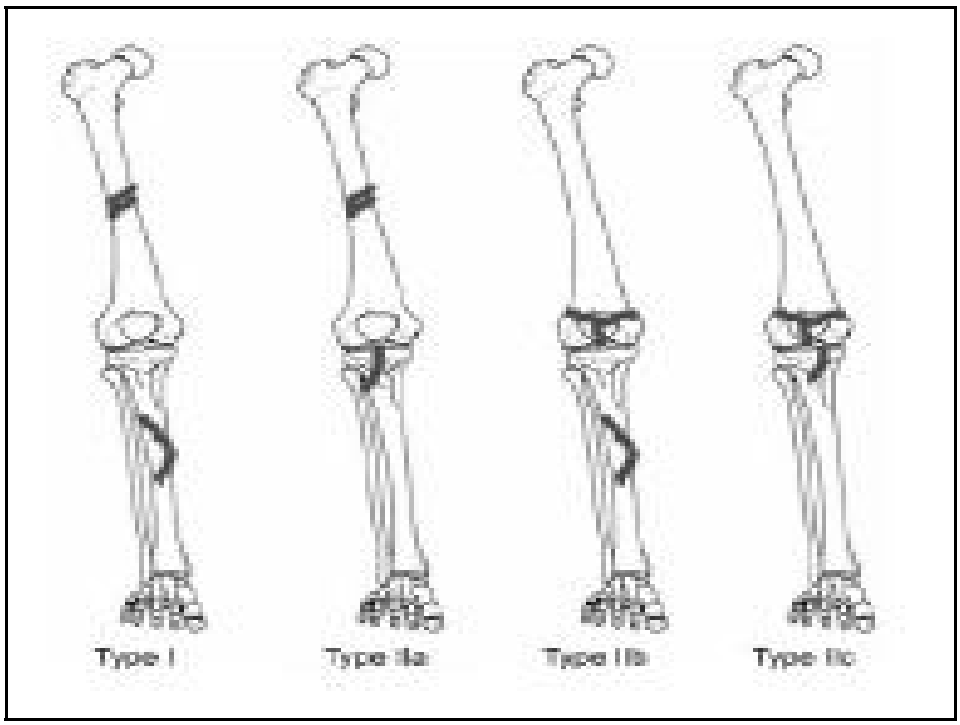
The knee joint is isolated completely and not involved with either shafts fractured

Type 2: Variant Floating Knee

Involves one or more joints with either shafts fractured

II A : The knee joint alone is involved

II B: Involves the hip or ankle joint.



A.O DISTAL FEMUR FRACTURE CLASSIFICATION

- ***Type A*** Extra articular
- ***Type A1*** Simple two part fracture
- ***Type A2*** Metaphyseal Wedge.
- ***Type A3*** Metaphyseal complex comminuted. Type B Partial articular
- ***Type B1*** Lateral condyle in sagittal plane
- ***Type B2*** Medial condyle in sagittal plane
- ***Type B3*** Fracture of both condyles in coronal plane
- ***Type C*** Complete intraarticular
- ***Type C1*** Articular simple, metaphyseal simple
- ***Type C2*** Articular simple, metaphyseal multifragmentary
- ***Type C3*** Multifragmentary intraarticular

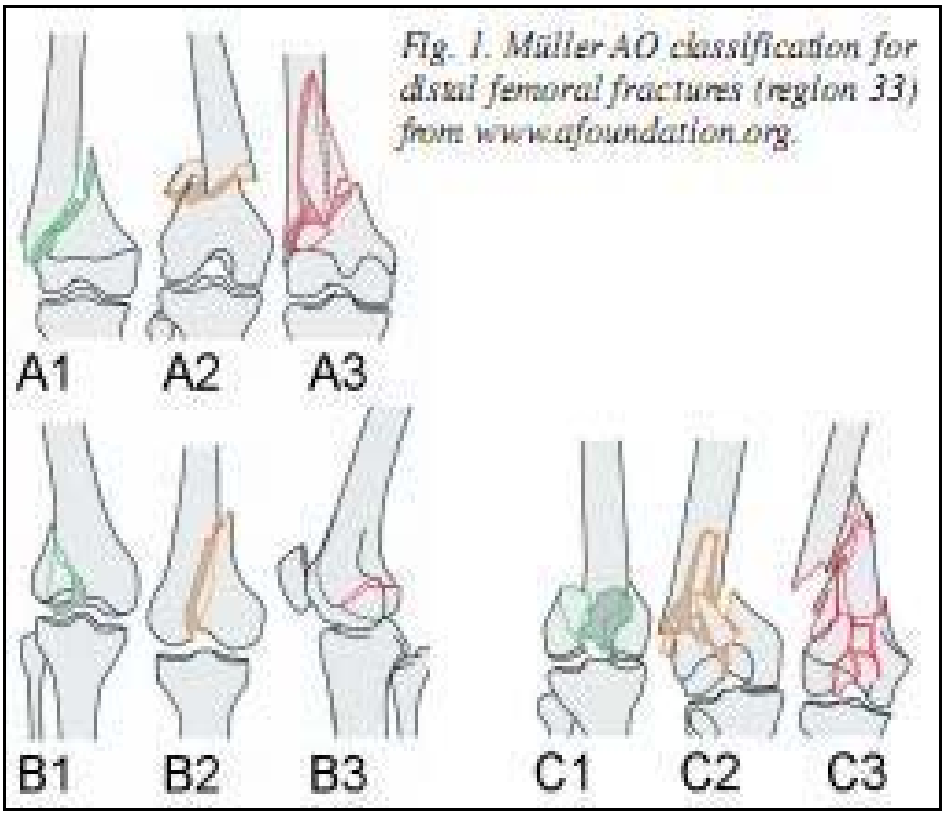
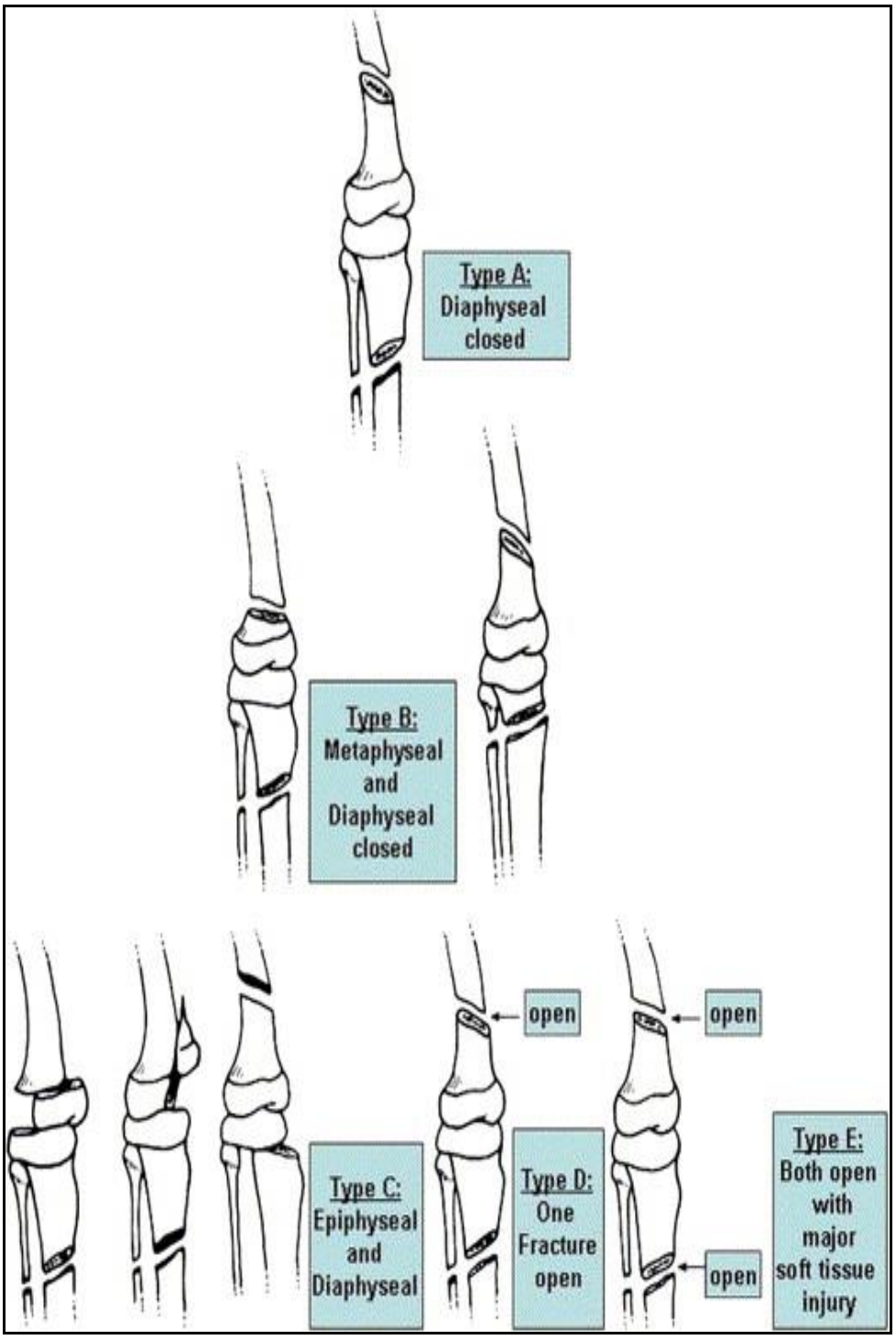


Fig. 1. Müller AO classification for distal femoral fractures (region 33) from www.afoundation.org.

LETT S CLASSIFICATION

TYPE	LOCATION	NATURE OF FRACTURE
A	Both diaphyseal	Both closed
B	One diaphyseal other metaphyseal	Both closed
C	Intraarticular extension in any one	Both closed
D	Regardless of site	One open
E	Regardless of site	Both open


Type A:
Diaphyseal
closed
Type B:
Metaphyseal
and
Diaphyseal
closed
Type C:
Epiphyseal
and
Diaphyseal
open
Type D:
One
Fracture
open
open
open
Type E:
Both open
with
major
soft tissue
injury

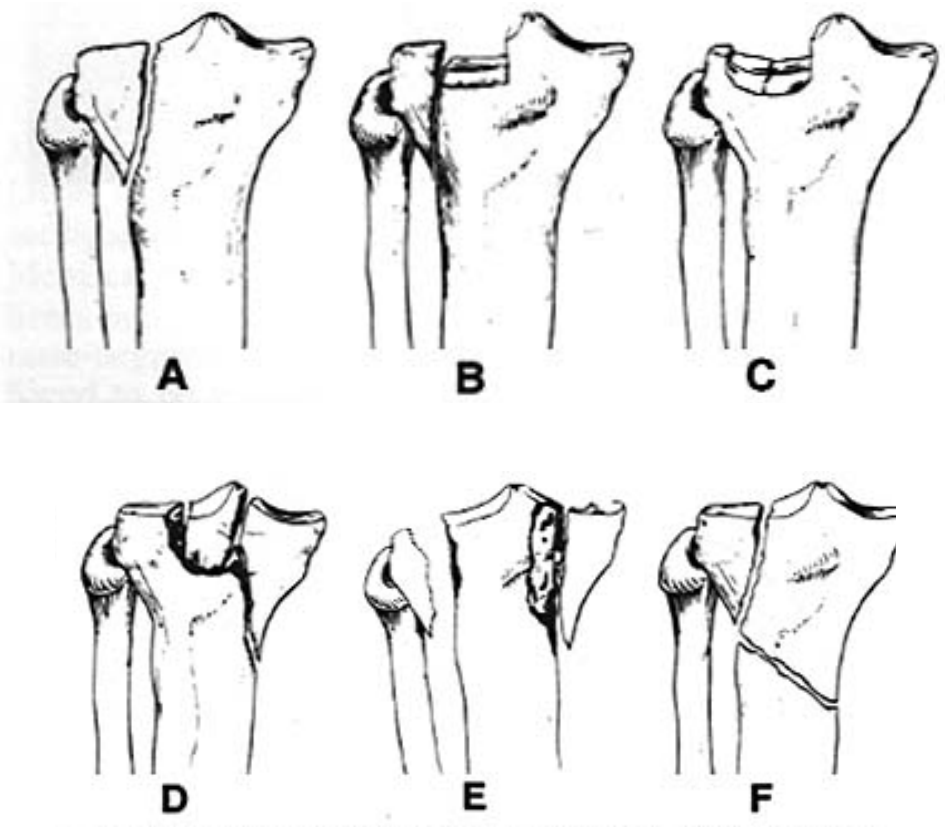


Fig. 3 Diagram of the Schatzker classification of tibial plateau fractures. **A,** Type I, cleavage of wedge fracture of the lateral tibial plateau. **B,** Type II, lateral split/depression fracture. **C,** Type III, pure central depression. **D,** Type IV, medial condyle fracture (may involve tibial spine). **E,** Type V, bicondylar fracture. **F,** Type VI, metaphyseal/diaphyseal disassociation. (Reproduced with permission from Schatzker J, McBroom R, Bruce D: The tibial plateau fracture: The Toronto experience 1968–1975. *Clin Orthop* 1979;138:94–104.)

MANAGEMENT

Depending upon fracture pattern of distal femur and A.O classification the management in literature is as follows.

For A1, A2, A3 fractures – Interernal fixation by 95 degree blade plate or condylar screw or antegrade or retrograde nailing or Limited contact dynamic compression plate (LCDCP) can be used.

For B1 and B2 fractures-Internal fixation by inter fragmentary lag screw with or without buttress plate can be used.

Type B3-fractures are fixed with interfragmentary lag screws.

For C1,C2 and C3 fractures-Interfragmentary lag screw, 95 degree blade plate/condylar screw/ antegrade or retrograde nailing along with reconstruction of articular surface by Kirschner wires or cancellous screws depending upon fracture pattern of proximal tibia and Schatzker classification the treatment options available are as follows.

- ***Type 1*** Open reduction with buttress plate or closed reduction and percutaneous screw fixation under image intensifier control.

- ***Type 2*** Open reduction, elevation of articular fragment with or without bone grafting and internal fixation with buttress plate.
- ***Type 3*** Closed reduction or arthroscopic reduction and internal fixation with screws with or without bone grafting. Non operative management in older age group.
- ***Type 4*** Open reduction and buttress plating or closed reduction and percutaneous fixation with screws.
- ***Type 5*** Closed reduction, minimal internal fixation with screws and ring fixator. Rarely open reduction and dual plating applied.
- ***Type 6*** Closed reduction, minimal internal fixation with screws and ring fixator.

OPEN FRACTURE MANAGEMENT

Open injury to the knee joint resulting from floating knee injuries require the same attention as is given for any other major joint. In the earlier pre antibiotic era, sepsis destroyed the well meaning technical expertise of surgeons who encountered these in their practice. Therefore prevention of wound sepsis will always remain the prime objective in the management of all open fractures.

This can be a far cry in the developing world where patients present late or referred late. It is universally agreed that, open fractures require emergency treatment which includes adequate debridement and irrigation of the wound. Beyond these two basic methods there is difference of opinion as to the following.

1) Primary or secondary wound closure.

2) Use of primary internal fixation.

Open fractures in long bones have been classified by

GUSTILO-ANDERSON CLASSIFICATION

Type 1: Open fractures with wound less than 1cm long and clean.

Type 2: Open fractures with laceration more than 1cm without extensive soft tissue damage, flaps or avulsions.

Type 3: High velocity injuries, an open segmental fracture, open fractures with extensive soft tissue damage or a traumatic amputation.

A -Adequate soft tissues cover despite high energy open fracture. B -Extensive soft tissue stripping and contamination.

C -Open fracture with vascular injury requiring repair.

COMPLICATIONS

Complications of floating knee injuries are classified into early and late

Early

1) Neurovascular injury

2) Fat embolism.

3) Compartment syndrome.

4) Infection and sepsis.

B) Late

1) Osteomyelitis.

2) Knee stiffness.

3) Malunion and non union.

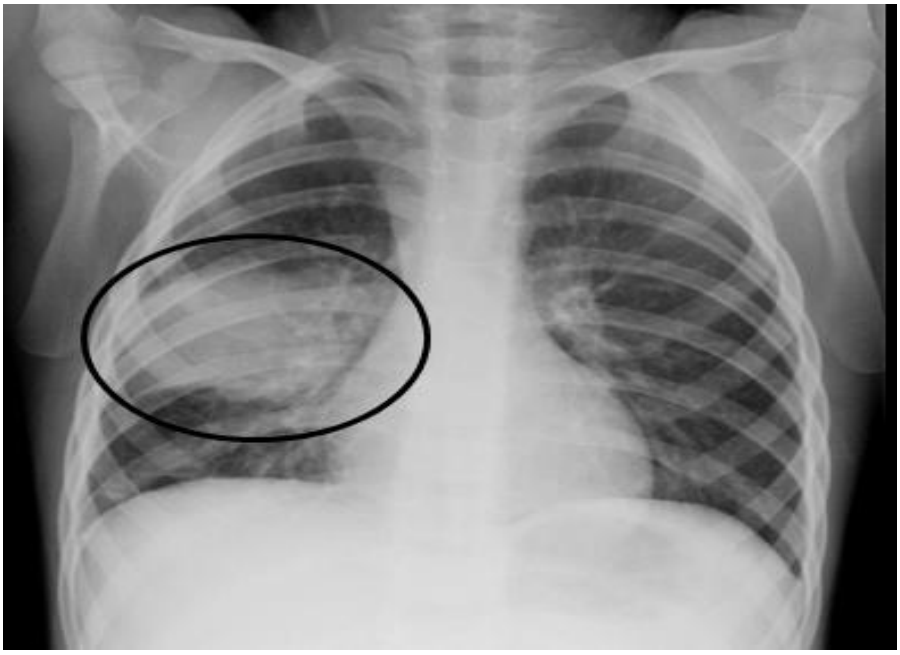
4) Shortening

FAT EMBOLISM SYNDROME

Fat embolism syndrome is a major cause of morbidity and mortality in heavily traumatized patients with fractures. Fat embolism syndrome involves Multiple organ systems causing devastating clinical deterioration within hours.

Gurds criteria are used for the diagnosis of fat embolism. It is subdivided in to major and minor criteria

Diagnosis requires one major criteria and four minor criteria.



GURD S CRITERIA FOR FAT EMBOLISM

MAJOR CRITERIA
Petechial rash
Respiratory insufficiency
Cerebral involvement
MINOR CRITERIA
Tachycardia >120/min
Fever > 39.4° C
Retinal signs-fat or petechiae
Jaundice
Renal signs-anuria or oliguria
LABARATORY FINDINGS
Sudden fall in Haemoglobin concentration
Sudden thrombocytopaenia
High ESR
Fat macroglobinaemia

INFECTION AND SEPSIS

The primary goal in treatment of all open fractures is asepsis. Thorough debridement, reduction and stabilization of the fracture should be followed by early soft tissue cover. Appropriate antibiotic cover is given. If infection seems to persists second look debridement of the wound is carried out every 24 to 48 hours till the infection is controlled.

Established osteomyelitis needs specific antibiotics on sensitivity reports and curettage and sequestrectomy if necessary

NEUROVASCULAR INJURY

All vascular injury patients are diagnosed by clinical examination and by doppler. The treatment of choice is exploration and primary repair or grafting of the arteries. If the vessels are thrombosed, thrombectomy is done. Fasciotomy is done if indicated. The nerve injuries are treated according to the type of injury patterns and nature of the wound whether closed or open.

Primary or delayed primary repair is done for the patients with neurotemesis and non operative management is required for patients with neuropraxia.

COMPARTMENT SYNDROME

It is a serious complication which should be detected early. Suspected when pain persists after immobilization, adequate analgesics have been administered, and there is increased pain on passive stretching of the muscle group involved. Tight bandages are removed and compartment pressures measured. Indications for fasciotomy are Normotensive patients having clinical features of compartment syndrome and compartment pressure more than 30 mm Hg. Duration of increased pressure not known or are more than 8 hours . Unconscious patients with compartment pressures more than 30 mmHg. MALUNION AND NON UNION

KNEE STIFFNESS

Knee stiffness is the commonest disability. It may result from Bony block due to improperly reduced intra articular fractures. Periarticular fibrosis due to surgery, trauma, implants. Extra articular causes like quadriceps fibrosis or adherence. Infection prolonged immobilization .

SHORTENING

Shortening usually follows communition, segmental fractures, traumatic bone loss and bone loss secondary to infection.

MATERIALS AND METHODS

This is a prospective study conducted in Department Of Orthopedic Surgery, MADRAS MEDICAL COLLEGE,CHENNAI This study is about the Functional Outcome of Surgical Managements of Ipsilateral Femur & Tibia Fractures [Floating Knee]. For this study 43 consecutive patients with ipsilateral femur and tibia fractures who presented to RGH casualty from MAy 2011-dec 2012 who fulfilled the criteria were included but 3 patients died ,and 3 patients ended up in non union. The patients were classified according to Blake and Mcbryde's Classification for floating knee injuries.

INCLUSION CRITERIA

1) All ipsilateral femur and tibia fractures in adults.

2) Both closed and open fractures.

EXCLUSION CRITERIA

1) Children with ipsilateral femur and tibia fractures – skeletally immature patients.

2) Associated neurological injuries such as paraplegia or quadriplegia resulting from spinal injuries

PRELIMINARY PROCEDURES DONE ON ADMISSION

When the patients presented in casualty primary survey of airway breathing and was hemodynamically stable necessary primary investigations were done. All fractures were splinted in Thomas splint or plaster of paris slab. Open fractures and wounds were documented properly. Cultures were sent. Adequate wound wash and irrigation was done with minimum of 5L of sterile normal saline. Appropriate antibiotics and prophylactic tetanus toxoid were started. The subject was included into the study once a diagnosis of floating knee injury was made in the Emergency room. Floating nee was classified according to Blake and Mcbryde's Classification. Open fractures were classified according to Gustilo and Anderson classification.

The plan of management for the given patient was made depending on the nature of fracture, location of fracture, associated soft tissue injuries. A primary survey was made and x-rays were taken to image the entire femur and tibia with the adjacent articulations of the knee hip and ankle. Primary care was given to all these patients and then they were operated. The patient was subjected to mobilization schedule according to associated injuries and general condition. The Out of the 43 patients 3 patients died.3

patients ended in non union. So they were excluded from the study. The final study comprised of 37 patients. Follow up study was done at 6 weeks, 12 weeks, 6 months and 1 year. Serial x-rays and functional assessment were carried out at each visit in outpatient clinic itself using the Karlstorm and Oleruds criteria. All the patients were assessed using a standard Proforma Out of the 37 patients who were followed up type 1 was seen in 29 patients, type 2A was 13 patients and type 2B was 1 patient. The details of pre operative status like mode of injury, fracture patterns, closed or open injuries and any associated injuries were

BLAKE AND MCBRYDE'S CLASSIFICATION

Blake and Mcbryde's Type	**Type -I**	**Type -IIa**	**Type -IIb**	**Total cases**
NO.OF PATIENTS	29	13	1	43

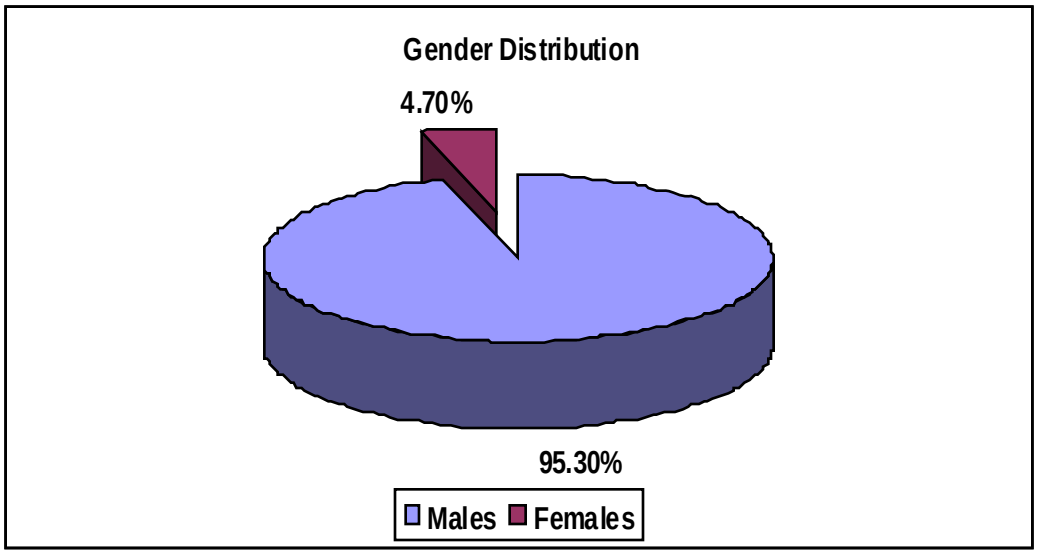
AGE DISTRIBUTION

The age distribution ranged from 18 to 80 years in our study.

AGE GROUP	NO.OF PATIENTS	PERCENTAGE
<20	4	9.3%
21-30	15	34.88%
31-40	11	25.58%
41-50	5	11.62%
51-60	4	9.3%
61-70	2	4.65%
>70	2	4.65%

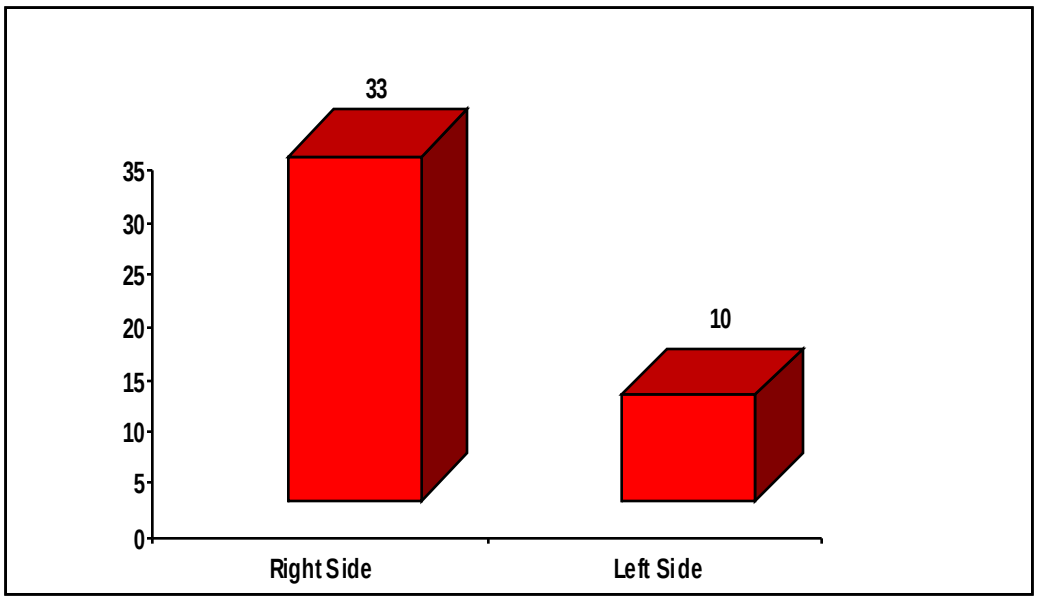
GENDER DISTRIBUTION

Males predominated in our study. Out of 43 patients 41 (95.3%) were male and the remaining 2 (4.7%) were females.

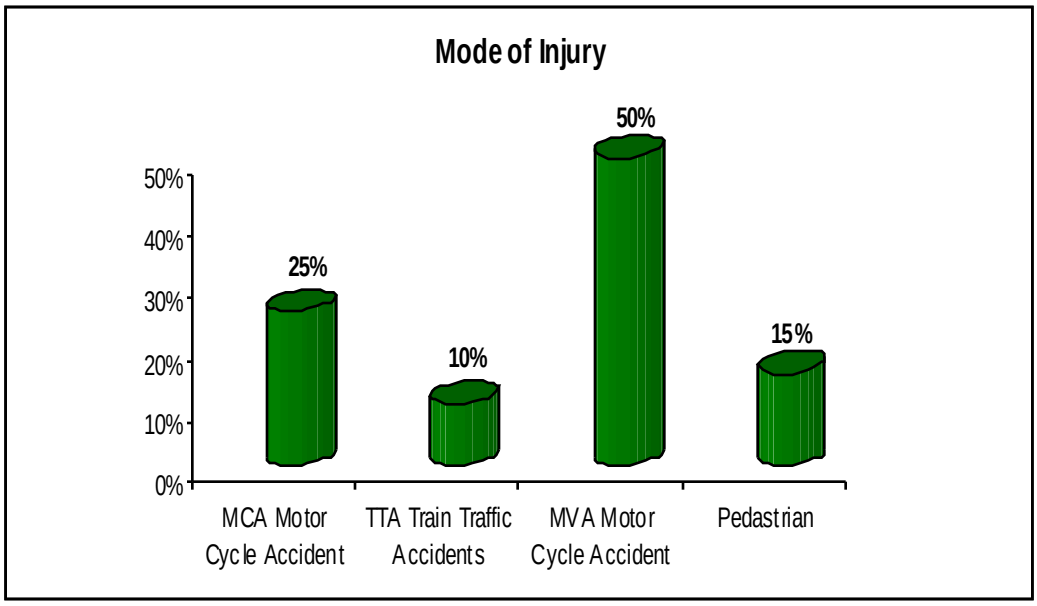


SIDE OF INJURY

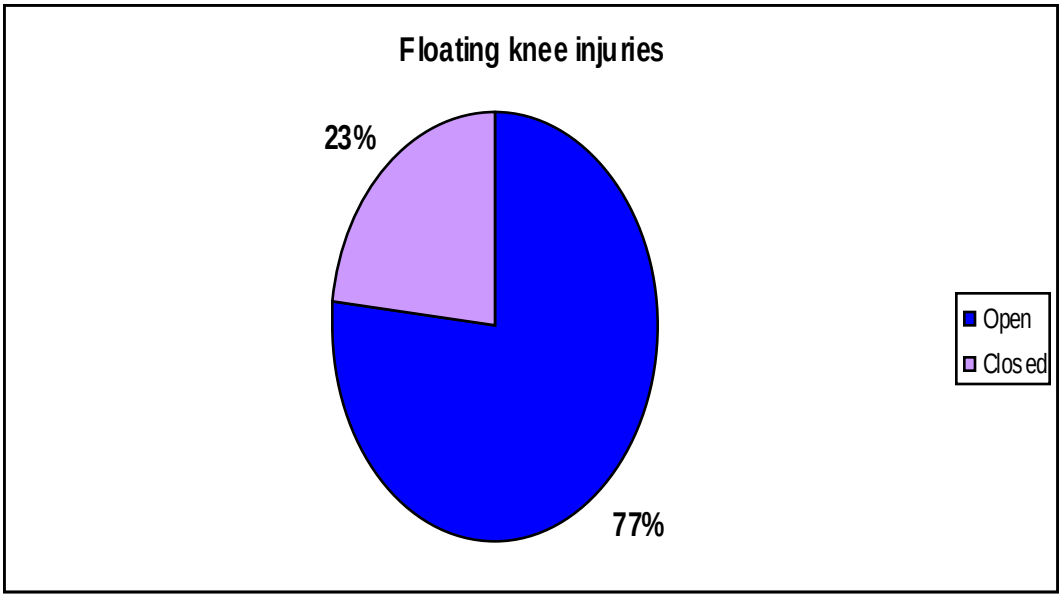
In our study out of 43 patients 33 patients were right sided injury and 10 were left sided injury



MODE OF INJURY



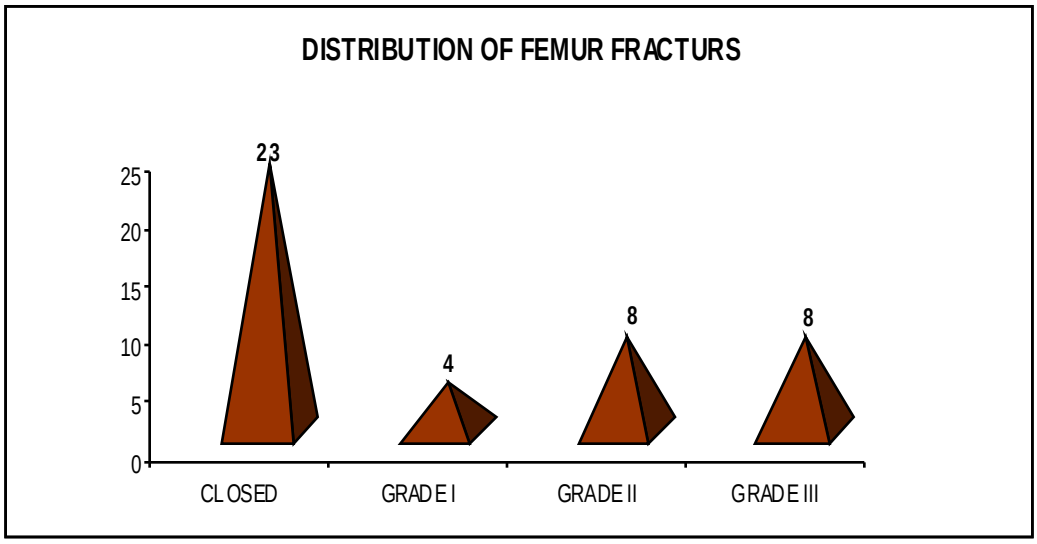
FLOATING KNEE INJURIES: OPEN AND CLOSED



Open injuries are common.

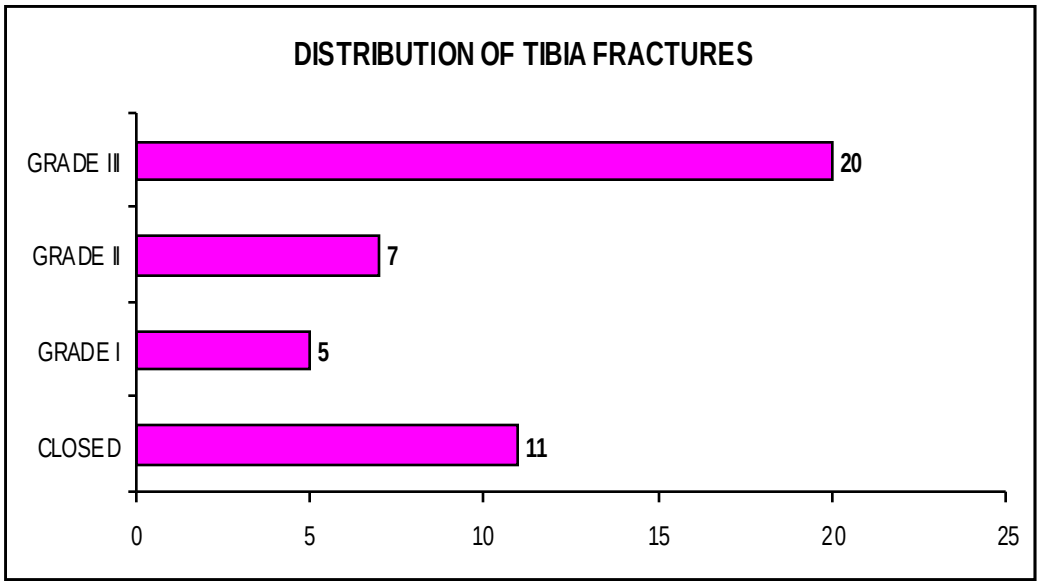
DISTRIBUTION OF FEMUR FRACTURS

TYPES	NO. OF FRACTURES	PERCENTAGE
CLOSED	23	53.4%
GRADE I	4	9.3%
GRADE II	8	18.60%
GRADE III	8	18.60%
TOTAL	43	100%



DISTRIBUTION OF TIBIA FRACTURES

TYPES	NO.OF FRATURES	PERCENTAGE
CLOSED	11	25.58%
GRADE I	5	11.62%
GRADE II	7	16.27%
GRADE III	20	46.51%
TOTAL	**43**	**100%**

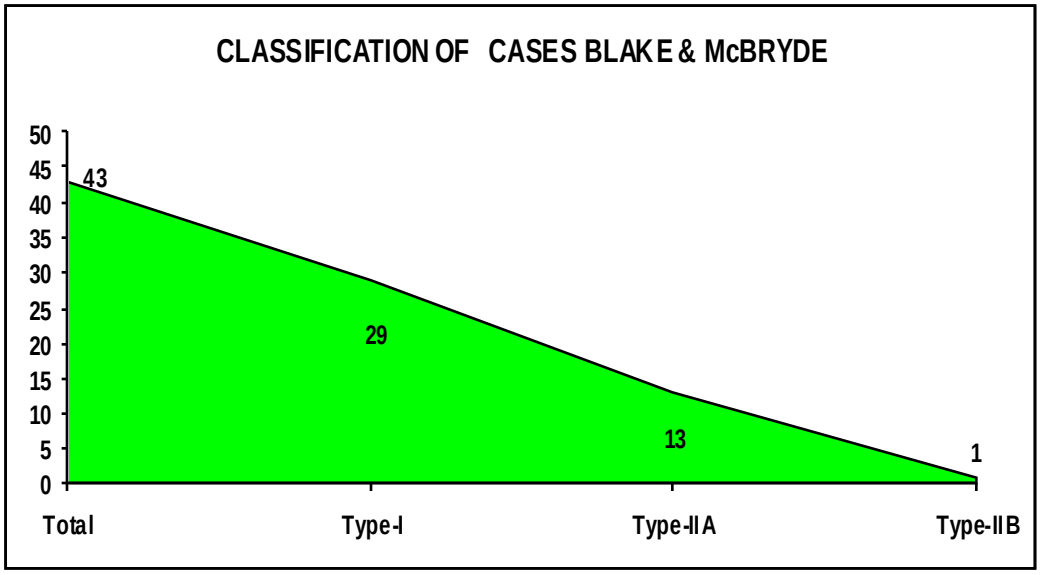


INTRA ARTICULAR DISTRIBUTION

16 Patients had intraarticular extension of fractures either femur or tibia.5 had intraarticular fracture of both tibia and femur

ONLY FEMUR	5
ONLY TIBIA	6
BOTH FERMUR AND TIBIA	5
TOTAL	16

CLASSIFICATION OF CASES BLAKE & MCBRYDE



Out of 43 cases, 29 were Type-I, 13 for Type-IIA, and 1 was Type II-B.

SURGERY PERFORMED

A) OF 8 patients involving grade III compound fractures of both tibia and femur 5 patients had knee spanning external fixators, 2 patients needed additional screws for stabilization. 1 patient had screw fixation for both femur and tibia. 1 patient had external fixation for tibia and limb reconstruction system for femur. 1 patient underwent primary amputation.

B) OF 10 patients with closed fractures, 4 patients had intramedullary nail for both femur and tibia. All femoral nails were antegrade and open nails. 1 patient had intramedullary nail for femur and AO plate for tibia. 2 patients had intramedullary nail for femur and conservatively managed using sarmiento method for tibia. 1 patient had AO plating for femur and conservative for tibia. 1 patient refused surgery. 1 patient died in the emergency ward with associated head injury before orthopaedic management.

C) OF 9 patients with closed femur and grade III compound fractures of tibia, all 9 patients had external fixation for tibia. Of the 9 femurs, 6 were nailed, 1 plated and 2 were externally fixed.

D) In 1 patient with grade 1 compound fracture of both femur and tibia, tibia was nailed and femur plated.

E) OF 4 patients with grade II compound fracture of both femur and tibia, 2 patients had knee spanning external fixation. 1 patient had both femur and tibia plated. 1 patient had plating for femur and external fixation for tibia.

F) OF 3 patients with closed femur and grade 1 fractures of femur, 2 patients had femur nailed and tibia conservatively managed. The other patient had popliteal artery injury and underwent external fixationand vascular repair.

G) In 1 patient with grade I compound fracture femur and closed tibia, femur was nailed and tibia was treated conservatively.

H) In 1 patient with grade I compound femur and grade II compound tibia, external fixation was applied because of severe abdominal and head injury.

I) In 2 patients with closed femur and grade II compound tibia, 1 patient had nailing for femur and tibia and the other patient had external fixation for tibia and intramedullary nail for femur.

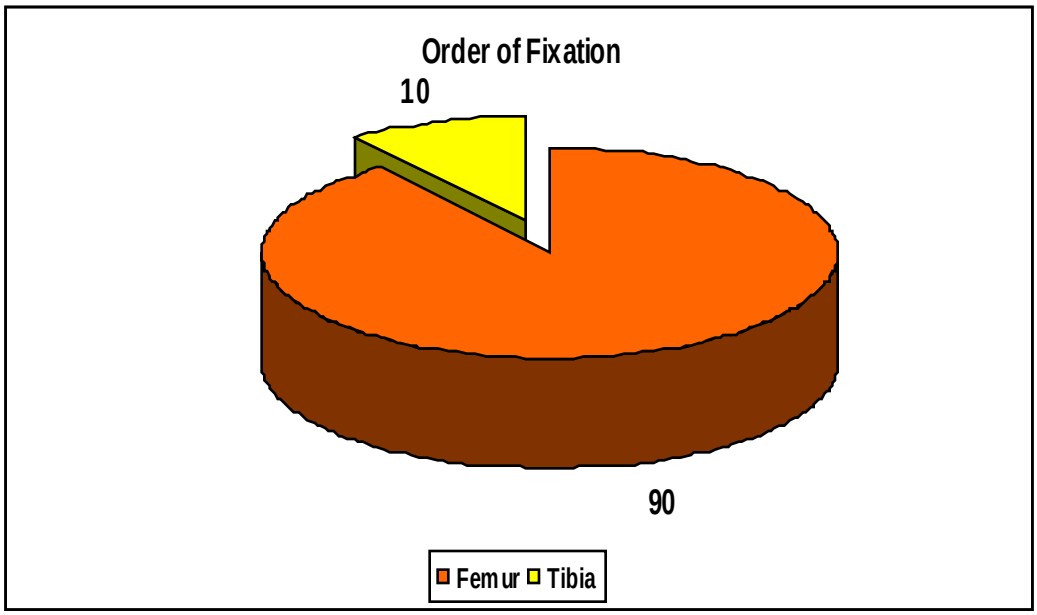
J) In 1 patient with grade I compound femur and grade in compound tibia, knee spanning external fixation was performed.

K) In 2 patients with grade II compound femur and grade III compound tibia, knee spanning external fixation was performed with 1 patient requiring screws additionally.

DURATION OF SURGERY

The duration of surgery ranged from 120 minutes to 330 minutes. The Mean was 202 minutes, Median was 191, Mode was 150 and Standard deviation was 57.555.

ORDER OF FIXATION



Femur is fixed first followed by tibia.

MANAGEMENT OF ASSOCIATED INJURIES:

Associated injuries were managed as appropriate. Concomitant upper limb (6) an <flower limb fractures (18) were fixed. Chest injury(3) was managed with intercostal drainage. Of the 6 head injuries, none required operative intervention. 2 patients had abdominal visceral injury and 1 of them required surgical management.

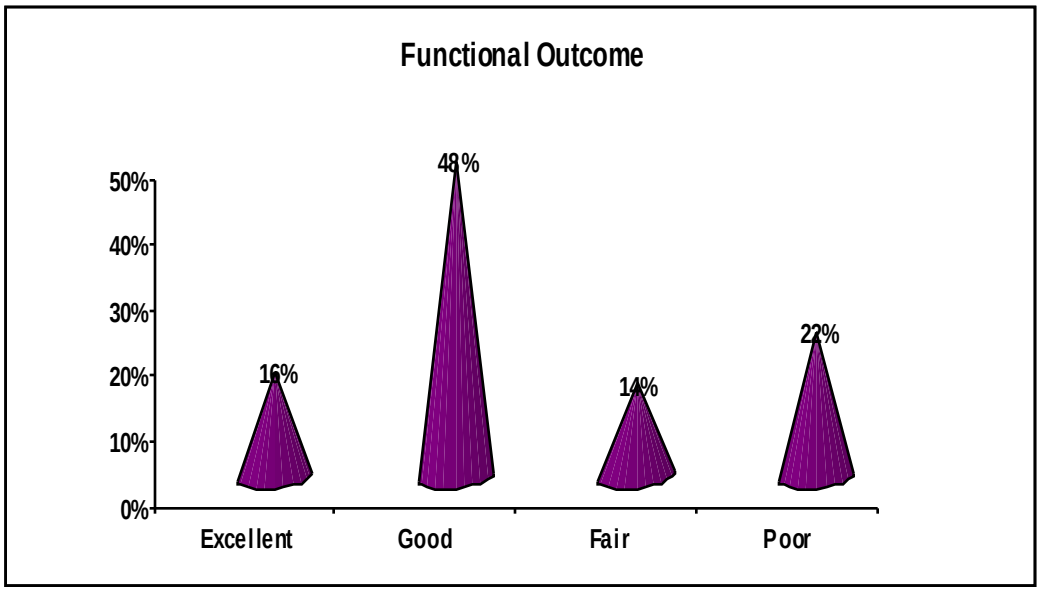
All grade III compound injuries were given flaps/split thickness grafts by a plastic team as soon as the wound was fit for cover. Serial debridements were done as appropriate. 2 of the patients with vascular injury required bypass grafting performed by a vascular team. 1 of the patients had a pre- excising peripheral vascular disease.

1 patient was retro positive and was ‘initially stabilized with external fixation. He refused 2" surgery. Replacement done 5 yrs back.1 patient had a crush injury of the contralateral lower limb which was unsalvageable and was amputated.

RESULTS

Non union was seen in 3 patients (6%).Further surgeries were planned in the form of LRS, Ilizarov for these patients. Malunion was observed in 6 pts (13%).Significant knee stiffness (ROM<90) was found in 11 patients (25%).Mean range of movements was 98degrees (min 30 max 130 degrees). Knee pain and stiffness was the most common complication in 18 patients. Limp was seen in 5 patients and laxity in 2 patients. Gait walking was unimpaired in 20 patients (46%) and only 1 patient needed to use crutches for walking. 3 patients died within the first week of admission. 28 patients required at least 1 plastic procedure (65%). Hospital stay was uncomplicated in 26 patients (60%). Superficial infection and pin site infection occurred in 11 patients (25%) and is the most common complication. Fat embolism was seen in 2 patients, ARDS in 3 patients.

FUNTIONAL OUTCOME USING KARLSTROM AND OLERUD CRITERIA



FLOATING KNEE INJURY

CASE -1

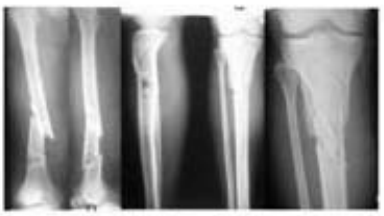
IMMEDIATE POST-OP

6 MONTHS (BONE GRAFTING)

ONE YEAR

FUNCTIONAL OUTCOME

CASE – 2



PRE-OP

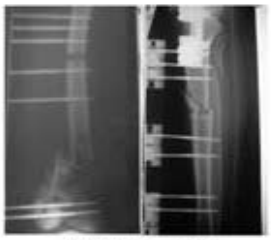
POST - OP

ONE YEAR

FUNCTIONAL OUTCOME

CASE – 3

PRE - OP



POST - OP

6 WEEKS
(COMPRESSION)

8 MONTHS

ONE YEAR

FUNCTIONAL OUTCOME

OUTCOME ANALYSIS USING KARLSTROM AND OLERUD CRITERIA

Out of a total of 43 patients, 3 died. 3 patients did not achieve bony union and hence could not be evaluated under the Karlstrom and Olerud criteria. Of the remaining 37 patients considered for analysis,

Criteria	Excellent	Good	Fair/ Acceptable	Poor
OUTCOME SUBJECTIVE LEG SYMPTOMS	18	12	7	0
SUBJECTIVE KNEE OR ANKLE SYMPTOMS	15	16	5	1
WALKINGABILITY	21	8	7	1
WORK & SPORTS	20	4	9	4
MALANGULATION,	23	5	8	1
MALROTATION OR BOTH				
LIMB LENGTH DISCREPANCY	23	4	9	1
RESTRICTED JOINT MOBILITY (HIP/KNEE/ANKLE)	9	17	3	8
COMPOSITE KARLSTOM&OLERUD	6	18	5	8

OUTCOMES OF SEGMENTAL FRACTURES

Criteria	Excellent	Good	Fair/ Acceptable	Poor
NON SEGMENTAL	5	14	4	7
SEGMENTAL TIBIA ALONE	0	2	1	0
SEGMENTAL FEMUR ALONE	0	1	0	0
SEGMENTAL BOTH FEMUR AND TIBIA	I	1	0	1

OUTCOMES OF COMMUNITED FRACTURES

Criteria	Excellent	Good	Fair/ Acceptable	Poor
NON COMMUNITED	5	4	1	3
COMMUNITED TIBIA ALONE	1	7	2	2
COMMUNITED FEMUR ALONE	0	2	0	0
COMMUNITED BOTH FEMUR AND TIBIA	0	4	3	3

OUTCOMES OF INTRA-ARTICULAR FRACTURES

Criteria	Excellent	Good	Fair/ Acceptable	Poor
NON ARTICULAR	5	14	2	4
INTRA- ARTICULAR TIBIA ALONE	0	0	1	2
INTRA- ARTICULAR FEMUR ALONE	1	2	1	0
INTRA- ARTICULAR BOTH FEMUR AND TIBIA	0	2	1	2

OUTCOMES BASED ON IMPLANTS/TREATMENT METHODS

Criteria	Excellent	Good	Fair/ Acceptable	Poor
Femur nail + tibia nail	4	1	0	0
Tibia nail + femur plate	1	0	0	0
Tibia plate + femur nail	0	1	0	0
Ex-fix for femur + tibia	0	4	3	2
Ex-fix for tibia + nail for femur	1	5	0	1
Conservative for tibia and nail for femur	0	4	0	0
Ex-fix for tibia + plate for femur	0	1	0	1
Conservative for tibia and plate for femur	0	1	0	0
Tibia plate + femur plate	0	1	0	0
Ex-fix for	0	0	1	0

OUTCOMES BASED ON AGE

Criteria	Excellent	Good	Fair/ Acceptable	Poor
10-19	0	1	1	1
20-29	5	9	2	0
30-39	0	4	1	5
40-49	0	1	1	1
50-59	0	2	0	0
60-69	1	1	0	0
70-89	0	0	0	1

OUTCOMES BASED ON INJURY SEVERITY SCORE

Criteria	Excellent	Good	Fair/ Acceptable	Poor
<10	1	5	0	2
11-20	1	3	0	2
21-30	3	4	2	3
31-40	0	2	1	1
41-50	1	3	2	2
>50	0	1	1	3

INFERENCE

Based on the above tabulations, the following conclusions can be drawn. Whether the fracture is closed or compound does not adversely affect the outcome (p=0.15) Communited fractures adversely affect outcome (p=0.04)Whether the fracture is intra articular does not adversely affect the outcome (p=0.22)Whether the fracture is segmental does not adversely affect the outcome (p=0.94)Age does not adversely affect the outcome (p=0.67)Injury severity score(ISS) does not adversely affect the outcome(>36) (p=0.8)Choice of implant affects the outcome (p=0.001).

Nailing for both femur and tibia produce the best results.

DISCUSSION

Floating knee injuries present with extensive soft tissue damage and other associated injuries.

Early and effective mobilization is the key to good outcome with minimal complications. Complications.

In our study which comprised of 43 patients ,6 had excellent outcome ,18 had good outcome ,5 had Had fair outcome and 8 had poor outcomes.

This study is comparable to national and international studies despite having higher incidence Of compound fractures, as the functional outcome of the same is good. Concomitant injuries are common and require a multidisciplinary approach.

Aggressive treatment of soft tissue defects with grafts and flaps are pre requisites for a successful Successful functional outcome.

SUMMARY

This study was conducted in the Department of Orthopedics, Madras medical college, chennai. This is a prospective study. The study – period was from may 2011to december 2012. The study included 43 consecutive patients with Ipsilateral femur and tibia fracture and who fulfilled the criteria. Out of the 43 patients 3 patients died and 3 patients went in non union. Hence a total of 37 patients were studied. The minimum follow up was 1 year. The last case which was included in the study was at september2012 The age of the patients ranged from 18 years to 80 years , the largest age group was 21 years to 30 years, which had fifteen (34.88%) patients. Males predominated our study. There were 41 (95.3%) males. Right sided injury was more common -33 (76.75%) Road traffic accident was the commonest cause – 39 (90.6%). Open fractures were seen in 33 (76.7%) and closed fractur in10 (23.25%) here were 16 (37.2%) intraarticular fractures. Type I Blake and McBryde's floating knee injuries were the commonest 29 (67.44%) cases.Among patients with excellent outcome had tibial nailing done.Initiation of knee mobilization ranged from 1

week to 17 weeks.Mean of 5.17 weeks.The overall average knee range of motion was 5 degree to 90 degree.

The average range of motion

Excellent	:	0 to 116 degree
Good	:	0 to 100 degree
Acceptable	:	0 to 90 degree
Poor	:	15 to 62 degree

CONCLUSION

- Floating knee injuries are due to high velocity trauma.
- Road traffic accidents are the commonest cause.
- Males are affected more
- Right side involvement is predominant.
- The most important factors which determine the functional outcomes were
- Type of fractures :OPEN or CLOSED
- Nature of communities: Intra articular involvement
- Post operative infections.
- Karlstrom and Olerud criteria is an effective scoring system to grade the functional outcome of floating knee injuries.

REFERENCES

1) Letts M, Vincent N, Gouw G. The "floating knee" in children. J Bone Joint surg Br 1986 May;68(3):442-46.

2) Veith RG, Winquist RA, Hansen ST Jr. Ipsilateral fractures of the femur and tibia. A report of fifty-seven consecutive cases. J Bone Joint Surg Am 1984 Sep;66(7):991-1002

3) Robert W. Bucholz, James D. Heckman-Rockwood and Greens fractures in adults, Fifth edition 2001;1731-70,1801-38,1845-1931. 4.

4) Blake R, McBryde A Jr . The floating knee: Ipsilateral fractures of the tibia and femur.South Med J 1975 Jan;68(1):13-6.

5) Karlstrom G, Olerud S . Ipsilateral fracture of the femur and tibia. J Bone Joint Surg Am 1977 Mar;59(2):240-43.

6) Fraser RD, Hunter GA, Waddell JP. Ipsilateral fracture of the femur and tibia. J Bone Joint Surg Br 1978 Nov;60-B(4):510-15.

7) Winston ME . The results of conservative treatment of fractures of the femur and tibia in the same limb. Surg Gynecol Obstet 1972 Jun;134(6):985-91

8) DeLee JC . Ipsilateral fracture of the femur and tibia treated in a quadrilateral cast brace. Clin Orthop Relat Res 1979 Jul-Aug;(142):115-22

9) Bansal VP, Singhal V, Mam MK, Gill SS The floating knee. 40 cases of ipsilateral fractures of the femur and the tibia. Int Orthop 1984;8(3):183-87.

10) Katada S, Ando K, Nakagawa K, Yamada T, Sasamoto H, Kawabe N et al.

11) Floating knee fracture (ipsilateral fracture of the femur and tibia)- treatment by closed Ender nailing. Nippon Seikeigeka Gakkai Zasshi 1984 May;58(5):475-83.

12) Behr JT, Apel DM, Pinzur MS, Dobozi WR, Behr MJ . Flexible intramedullary nails for ipsilateral femoral and tibial fractures. J Trauma 1987 Dec;27(12):135457.

13) Gregory P, DiCicco J, Karpik K, DiPasquale T, Herscovici D, Sanders R. Ipsilateral fractures of the femur and tibia:

treatment with retrograde femoral nailing and unreamed tibial nailing. J Orthop Trauma 1996;10(5):309-16.

14) Lobenhoffer P, Krettek C, Tscherne H. [Complex knee joint trauma] Orthopade. 1997 Dec;26(12):1037-45.

15) Ostrum RF . Treatment of floating knee injuries through a single percutaneous approach. Clin Orthop Relat Res. 2000 Jun;375:43-50.

16) Rethnam U . Single incision nailing of the floating knee-do we ignore the knee ligaments?. Int Orthop 2006 Aug;30(4):311.

17) Van Raay JJ, Raaymakers EL, Dupree HW. Knee ligament injuries combined with ipsilateral tibial and femoral diaphyseal fractures: the "floating knee". Arch Orthop Trauma Surg 1991;110(2):75-7.

18) Rethnam U, Yesupalan RS, and Nair R. The floating knee: epidemiology, prognostic indicators and outcome following surgical management. J trauma manage outcomes 2007;1-8.

19) Lundy DW, Johnson KD. "Floating knee" injuries: ipsilateral fractures of the femur and tibia. J Am Acad Orthop Surg 2001 Jul-Aug;9(4):238-45.

20) Theodoratos G, Papanikolaou A, Apergis E, Maris J: simultaneous ipsilateral diaphyseal fractures of the femur and tibia: treatment and complications. Injury 2001;32(4):313-15.

21) Singaravadin Vaidyanathan, Jagannath Panchanathan Ganesan, and Mugundhan Floating knee injury associated with a case report and review of literature 2012, articles Id 913230.

22) Ulfin Rethnam Rajam Syes Upalan and Rajagopalam Nair, The floating knee: outcome following Surgial Mangament-J Trauma Management and Outcomes.

ANNEXURE – I

KARLSTROM AND OLERUD CRITERIA FOR UNCTIONAL ASSESSMENT AFTER MANAGEMENT OF FLOATING KNEE

Criterion	Excellent	Good	Acceptable	Poor
SUBJECTIVE SYMPTOMS FRO THIGH OR LEG	0	Intermittent slight symptoms	More severe symptoms impairing function	Considerable functional impairment; pain at rest
SUBJECTIVE SYMPTOMS FROM KNEE OR ANKLE JOINT	0	Same as above	Same as above	Same as above
WALKING ABILITY	Unimpaired	Same as above	Walking distance restricted	Uses cane, crutch or other support
WORK AND SPORTS	Same as before accident	Given up some sport; work same as before accident	Change to less strenuous work	Permanent disability
ANGULATION, ROTATIONAL DEFORMITY, OR BOTH	0	<100	10-200	>200
SHORTENING	0	<1cm	1-3cm	>3cm
RESTRICTED JOINT MOBILITY (HIP, KNEE, OR ANKLE)	0	<100 at ankle; <20o at hip, knee, or both	10-200 at ankle; 20-400at hip, knee or both	>200 at ankle; >400 at tip, knee, or both

ANNEXURE II

PATIENT'S PROFORMA

S. No

Name: Age:

PIMS NO.:

Sex : Male / Female

Address: Phone No.:

Mechanism of injury :

MVA [Four wheeler]

MCA [Two wheeler] Fall form height

Date and Time of Injury:

Place of Injury :

Associated factors influencing injury:

H/o seizure disorder / alcohol

Consumption / any other

Time of presentation :

Associated General illness : DM / HT / any other

TYPE OF FRACTURE

Femur Closed

Open-

Grade I Grade II Grade III A Grade IIIB

Grade III C

Type of Fracture

Transverse Comminuted Segmental

Level of fracture

Diaphyseal

Diaphyseal Metaphyseal Junction

Intraarticular

Intertrochanteric.

Tibia

Closed Open Grade I Grade II Grade III A Grade IIIB

Grade III C

Type of Fracture

Transverse Communited Segmental

Level of fracture

Diaphyseal

Diaphyseal

Metaphyseal

junction

Intraarticular Knee

Intraarticular Ankle.

Blake and Mc Bride Type

Type 1

Type 2A

Associated other injuries

Lower Limb

Upper Limb

Spine

Head injury

Chest injury

Abdominal injury

Associated injury in the same limb

Vascular injury

Nerve injury

Crush injury of foot

Metatarsal fractures

Calcaneal fractures

Pelvis and sacral injury

Associated ipsilateral injuries specific to knee

Patellar fractures

Avulsion of tibial tuberosity injury

Time of presentation :

Time of operation :

Duration :

Procedures done before final fixation :

Type of surgery :

Femur :

Ex Fix

Plating

Cruciate ligament

Meniscal injury

IMIL Antegrade nailing

IMIL Retrograde nailing

Plating

IMIL nailing

Ilizarov

Average time duration of surgery : Average blood loss

Order of fixation : 1st
2nd

Post op complications : DIC
Fat Embolism
Infection
Implant failure

Delayed union

Mal union

Nerve injury

Amputation Death

Additional procedures: Wound debridement Wound coverage Exchange of implant

Re-alignment procedures

Implant removal

Ligament reconstruction

Menisectomy

Any other

Post op protocol: Knee mobilization started at: Weight bearing:

Any additional splintage

Bony union

Femur: Tibia:

Range of movement

Hip: Knee:

Ankle:

Deformity at the fracture site

Femur: Tibia:

FUNCTIONAL OUTCOME

Dates of follow up

Duration

EXCELLENT

GOOD

ACCEPTABLE

POOR

ANNEXURE III

CONSENT FORM

Dear Volunteers,

We welcome you and thank you for your keen interest in participation in thisresearch project. Before you participate in this study, it is important for you tounderstand why this research is being carried out. This form will provide you all therelevant details of this research.

It will explain the nature, the purpose, the benefits,the risks, the discomforts, the precautions and the information about how this projectwill be carried out. It is important that you read and understand the contents of theform carefully. This form may contain certain scientific terms and hence, if you haveany doubts or if you want more information, you are free to ask the study personnel orthe contact person mentioned below before you give your consent and also at any timeduring the entire course of the project .

Project Title : Study of functional outcome of surgical management of ipsilateral femur and tibia fracture. [Floating knee]

Department and Institute : Department Of Orthopedic Surgery
Madras Medical College,
Chennai-600 003.

Name of the investigator : Dr.SIVASARAVANAN

What is the purpose of this project / study?

a. To study the incidence, patterns and morphology of ipsilateral femur and tibia fractures, their management modalities and results.

b. To identify any modifiable factor affecting the eventual functional result.

4. What is the selection procedure of participants/ (Including the inclusion and exclusion criteria)

A. INCLUSION CRITERIA

1] All ipsilateral femur and tibia fractures in adults.

2] Both closed and open fractures. b. EXCLUSION CRITERIA

1] Children with ipsilateral femur and tibia fractures – skeletally immature patients.

2] Associated neurological injuries such as paraplegia or quadriplegia resulting from spinal injuries.

5. How will it be carried out Procedure of the study?

Patients who are admitted with ipsilateral femur and tibia fractures and those who fulfill the criteria will be included in the study immediately.

6. What are the responsibilities of the participants?

The patients have to follow the protocol of the management as per the fracture type and any co morbidities if present as advised by the treating surgeon.

7. What are the expected risks for the participants?

There are absolutely no risk for the participant since the total management is based only on the type and pattern of the fracture the patient has.

8. What are the expected benefits of the research to the participants?

As it is there are no benefits for the participants but the most advanced and appropriate treatment will be given.

9. Will participants be compensated for participation in this trial?

No there won't be any compensation given.

10. Whether my participation in this study be kept confidential?

Yes the confidentiality will be maintained.

11. Can I withdraw from the study at any time during the study period?

Yes the participant has right to withdraw from study at anytime.

12. If there are any new findings/ information, would I be informed?

Yes the participant will be informed about the new findings or information.

13. What happens in case of a study related injury?

There won't be any case related injury since the management is totally based on type and pattern of the fracture.

14. Is there any alternate to the treatment mentioned?

No there are no alternate types of treatment. If it's there it will be informed and choice will be given to the participant.

Place :
Date :

CONSENT FORM

Participant's name: Address

Title of the project: Study of functional outcome of surgical management of ipsilateral femur and tibia fracture. [Floating knee]

The details of the study have been provided to me in writing and explained to me in my own language. I confirm that I have understood the above study and had the opportunity to ask questions. I understand that my participation in the study is voluntary and that I am free to withdraw at any time, without giving any reason, without my medical care or legal rights being affected. I agree not to restrict the use of any data or results that arise from this study provided such a use is only for scientific purpose (S). I also received a copy of the "Consent Form 1 of

Signature of the participant Signature of the witness

Date:

ஆராய்ச்சி ஒப்புதல் படிவம்

ஆராய்ச்சி தலைப்பு

குறுகிய கால எதிர்கால பகுப்பாய்வு

ஒருபக்க தொடை மற்றும் கால் எலும்பு முறிவிற்கு (Floating Knee) பலவிதமான அறுவை சிகிச்சை முறைகள் குறித்து ஒரு ஆய்வு

சென்னை இராஜீவ்காந்தி அரசு பொது மருத்துவனையின் எலும்பு முறிவு சிகிச்சைப்பிரிவில் ஒருபக்க தொடை மற்றும் கால் எலும்பு முறிவிற்கு (Floating Knee) பலவிதமான அறுவை சிகிச்சை முறைகளின் பயன்களை அறிவதற்கான ஆய்வு.

பெயர் :
வயது :
பால் :

தேதி :
உள்நோயாளிகளின் பிரிவு:
ஆராய்ச்சி சேர்க்கை எண்:

இந்த ஆராய்ச்சியின் விவரங்களும் அதன் நோக்கங்களும் முழுமையாக எனக்கு தெளிவாக விளக்கப்பட்டது.

எனக்கு விளக்கப்பட்ட விஷயங்களை புரிந்துகொண்டு நான் எனது சம்மதத்தை தெரிவிக்கின்றேன்.

இந்த ஆராய்ச்சியில் பிறரின் நிர்பந்தனையின்றி என் சொந்த விருப்பத்தின்பேரில்தான் பங்கு பெறுகின்றேன் மற்றும் நான் இந்த ஆராய்ச்சியிலிருந்து எந்நேரமும் பின்வாங்கலாம் என்பதையும் அதனால் எந்த பாதிப்பும் ஏற்படாது என்பதையும் நான் புரிந்துகொண்டேன்.

இந்த ஆராய்ச்சியில் ஏற்படும் நன்மைகளையும் சில பக்கவிளைவுகளையும் பற்றி தெளிவாக மருத்துவர் மூலம் தெரிந்துகொண்டேன்.

நான் என்னுடைய சுய நினைவுடனும் மற்றும் முழு சுதந்திரத்துடனும் இந்த மருத்துவ ஆராய்ச்சியில் என்னை சேர்த்துக்கொள்ள சம்மதிக்கிறேன்.

ஆராய்ச்சியாளரின் கையொப்பம்

பங்கேற்பாளரின் கையொப்பம்

நாள் :
இடம் :

MASTER CHART- TABLE 4

A	B	C	0	E	F	G	H	1	J	K	L	M	N	0	P	Q	R	S	T	u	V
23	m	32	0	3f.3t	0	2	0	3	3LRS	n.y.a	n.y.a	na	1	0to30	u	n.y.a	0	planned ilizarov tibia	13m		I
18	m	75	1,4,5	2t,lf	0	2	0	3	3	na	na	na	na	na	na	na	3,4,6	na	died 5 days		I
IS	m	45	3	lf	0	2	0	5	1	7	6	0	0	0 to 110	0	0	0		84m		I
42	m	20	7	lt	0	lf	0	5	1	n.y.a	n.y.a	0	0	Oto90	bl	n.y.a	1,2,13	1,2	9m		I
37	m	50	1,7	3f,3t	0	2	lf	3	3	na	na	na	na	na	na	na	6,8,9,17	v, 5 ,ssg	8m		2a
44	m	41	6,7	2f,2t	0	2	lt	3	3	5	s	0	1	Oto80	bldl	1	0	refused repeat surgery	6m		2a
18	m	41		3t	0	0	0	3	2	6	5	0	1	0to60	b2dl	1	0	flap, failed ssg redo ssg	6m		1
36	m	9		0	0	2	lf	5	5	7	6	2	1	0to70	a2b2	2	0	-	8m		2a
65	m	18		2t	0	lt	0	3	1	5	7	0	0	0 to 110	bl	1	0	ptb cast	8m		1
24	m	16		0	0	2	0	5	1	3	3	0	0	0 to 130	bl	0	0	ptb cast	6m		1
25	m	9		0	0	lf	0	5	1	4	4	0	0	0 to 110	0	0	0	ptb cast	6m		1
50	m	50		2f,2t	0	0	0	3	2	4	3	0	0	0 to 100	0	0	0	0	9m		2a
25	f	9		0	fl	0	0	1	1	3	IS	0	0	0 to 100	bl	0	0	-	6m		1
47	m	9		3t	0	0	0	3	1	4	4	0	0	0 to 110	0	0	0		7m		1
33	m	41		3t	tl	lt	lt	3	3	5	4	0	0	0 to 110	0	0	2	flap cover	7m		2a
27	m	9		0	0	tl	0	2	1	3	3	0	0	0 to	0	0	0		6m		1

														110							
24	m	9		lt	0	lt	0	5	1	4	4	0	0	0 to 110	bl	1	0		6m		1
35	m	9		3t,2 f	2	lt	0	3	3	5	4	0	1	Oto 40	a2b 3	2	1,2	flap cover, 2	6m		1
17	m	2 5		3t	0	lt	0	3	3	6	5	1	0	Oto90 0	b2	2	1,2	?	6m		1
22	m	2 5		0	0	0	0	1	1	3	3	0	0	Oto 130	0	0	0	0	8m		1
67	m	9		0	0	0	6	1	1	3	3	0	0	Oto 130	0	0	0	0	7m		1
25	m	2 5		3t	0	lt	0	3	1	3	3	0	0	Oto 120	0	0	2	ssg	9m		1
31	m	2 5		lf,3t	0	2	lf	3	3	7	6	0	1	Oto 80	b2d 2fl	1	1	2	6m		2a
44	m	2 5		3t	0	lt	0	3	1	5	5	0	1	Oto 30	b3	1	2	ptb cast	6m		1
32	m	2 5		3f,3 t	. 0	2	2	4, 3	4,3	7	7	0	1	-10 to 30	b2d »2	1	0	1	13 m		2a
30	m	2 5		2f,2 t	0	0	0	3	3	6	5	0	0	Oto 95	0	1	3		8m		1
22	m	4 1		3t	2	lt	lt	3	1	4.5	4	0	0	Oto 110	32	0	2	ssg, 2	8m		2b
35	m	2 S		2f,2 t	0	2	2	2	2	4	4	0	0	Oto 110	*ml*	0	2	0	6m		2a
75	m	3 2		2t3t	0	0	lf	3	4,3	6	5	1	1	Oto 70	al	1	2,1 6	7	7m		2a
27	m	4 1	3,4, 7	2f,lt	lf	0	0	1	3	6	5	1	0	Oto 110	a2bl	1	2	2	6m		1
26	m	2 5		2t	2	0	0	1	1	3	3	0	0	Oto 130	0	0	4	0	6m		1
2S	m	4 5	1,2, 3,	1.1	0	0	0	1	2	2	2	0	0	Oto 130	0	0	0	0	6.5 m		1
30	m	2 5		3f,3 t	0	2	2	4, 3	4,3	6	5	2	1	Oto 70	0	1	0	ssg	6m		2a
50	m	7 5	1,4, 5, 6,7	3f,3 t	2	2	lf	a m P	am p	na	na	na	na	na	na	na	3,9		died 3da ys		2a
30	m	2 5		0	0	lt	0	5	2	4	4	0	0	Oto 110	*2	1	0	ptb cast	7m		1
21	m	3 2		3f,3 t	0	2	2	4	4	3	2.5	0	0	Oto 130	fl	1	0		6m		2a
51	m	3 2		3t	0	lf	0	3	1	5	5	0	0	Oto 110	bl	0	0	ptb cast	6m		1

24	m	16		0	0	0	0	1	1	6	5	0	0	Oto 130	0	0	0	0	13m		1
38	m	13		0f,lt	0	0	0	3	3	9	9	1	1	Oto 80	c2d3	2	2,10	fasciotomy, V	10m		1
24	m	16		3f,3t	0	2	2	3	3	4	4	0	0	Oto 125	bl	0	0	ssg	6m		2a
20	m	57	2,3,7	3f,3t	lf	lt	0	3	3	5	5	0	0	Oto 110	bl	0	0	ssg, ptb cast	6m		1
80	m	75		0	0	lt	0	na	na	na	na	na	na	na	na	na	6,8	na	died adm	l	1
21	m	25	0	3t	0	lt	lt	3	1	4	4	0	0	0-130	0	0	0	flap cover	13m	l	2a

A Age at index operation (years)
B Sex
  m male
  f female
C Injury severity score
D Associated injuries
  0 none
  1 head/neck injury
  2 facial injury
  3 upper limb/clavicle injury
  4 chest injury
  5 abdominal/pelvic viscera injury
  6 pelvic bony injury
  7 other lower extremity injury
  8 thoracic/lumbar spine injury
E Open/closed fractures
  0 closed
  1 grade I open ft
  2 grade II open ft
  3 grade III open ft
F Segmental fractures
  0 not segmental
  1 segmental in 1 bone ft
  2 segmental in both bones
G Comminuted fractures
  0 no signi cant comminution
  1 comminution in 1 bone ft
  2 comminution in both bones
H Intra-articular fractures
  0 extraarticular
  1 intraarticular in 1 bone ft
  2 intraarticular in both bones
I Tibia treatment
  1 intramedullary nail
  2 plate
  3 external xator
J Femur treatment
  1 intramedullary nail
  2 plate
  3 external xator
K Time-to-full weight bearing (months)
L Time-to-bony union (months)
  p pseudarthrosis
M Significant malunion
  0 none
  1 1 bone malunited ft
  2 both bones malunited
N Significant knee stiffness
  0 none
  1 stiff knee
O Knee range of motion
P Pain/subjective complaints
  a knee effusion/swelling
  b knee pain/stiffness
  c ankle pain/stiffness
  d limp
  e hip pain/stiffness
  f knee laxity
  0 none
  1 intermittent, slight
  2 more severe symptoms impairing function
  3 considerable functional impairment, pain at rest
Q Gait walking ability
  0 unimpaired
  1 intermittent, slight impairment
  2 restricted
  3 need to use cane or crutch
R Complications
  0 none
  1 osteomyelitis
  2 wound infection/pin-site infection
  3 adult respiratory distress syndrome
  4 fat embolism
  5 pneumonia
  6 hypovolemic shock
  7 coagulopathy
  8 significant anemia (< 7 g/dL)
  9 septicemic shock
  10 compartment syndrome
  11 posttraumatic stress reaction
  12 loosening of screw
  13 nonunion ft
  14 bleeding stress ulcer
  15 cholangitis
  16 urinary tract infection
  17 arterial thrombosis
S Repeat surgery
  0 none
  1 bone grafting
  2 nail conversion
  3 plate conversion
  4 knee arthrodesis
  5 above-knee amputation
  6 refused repeat surgery
  7 dynamization of locking screw
ft (f = femur, t = tibia)
T Follow up
U Side involved
V Blake & McBryde Classification

INSTITUTIONAL ETHICS COMMITTEE
MADRAS MEDICAL COLLEGE, CHENNAI -3

Telephone No : 044 25305301
Fax : 044 25363970

CERTIFICATE OF APPROVAL

To
Dr.Sivasaravan .S
PG in MS Orthopaedics
Madras Medical College, Chennai -3

Dear Dr.Sivasaravan .S

The Institutional Ethics committee of Madras Medical College, reviewed and discussed your application for approval of the proposal entitled "A study on functional outcome of surgical management of Floating knee" No.16092012.

The following members of Ethics Committee were present in the meeting held on 13.09.2012 conducted at Madras Medical College, Chennai -3.

1. Dr. S.K. Rajan. M.D.,FRCP.,DSc	-- Chairperson
2. Prof. Pregna B. Dolia MD Vice Principal, Madras Medical College, Chennai -3 Director , Institute of Biochemistry, MMC, Ch-3	-- Member Secretary
3. Prof. B. Vasanthi MD Professor of Pharmacology ,MMC, Ch-3	-- Member
4. Prof. M. Reghu MD Director, Inst. Of Internal Medicine, MMC, Ch-3	-- Member
5. Prof. MD. Ali. MD.DM Prof & HOD of MGE, MMC, Ch-3	-- Member
6. Prof. P. Karkuzhali. MD Director i/c, Prof., Inst. of Pathology, MMC, Ch-3	-- Member
7. Prof. Bavani Shankar. MS Prof of General Surgery, MMC, Ch-3	-- Member
8. Thiru. S. Govindsamy. BABL	-- Lawyer
9. Tmt. Arnold Soulina MA MSW	-- Social Scientist

We approve the proposal to be conducted in its presented form.

Sd/ Chairman & Other Members

The Institutional Ethics Committee expects to be informed about the progress of the study, and SAE occurring in the course of the study, any changes in the protocol and patients information / informed consent and asks to be provided a copy of the final report.

Member Secretary, Ethics Committee